TO-16: Multi-facility TMA Requirements for Philadelphia Installation

System Resources Corporation

AATT NRA Workshop

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Outline

- **Objectives**

- **Task Description**
  - Team
  - Approach
  - Deliverables

- **Results**

- **Conclusions**

Objectives

- Establish initial understanding of PHL for ultimate implementation of TMA
  - PHL arrival operations (current & planned)
  - PHL coordination/operational procedures with ZNY and ZDC
- Identify and examine candidate operational concepts for TMA implementation
  - system concepts, software algorithm modifications, and adaptation requirements
- Outline work plan and staffing requirements for TMA integration

Task Description: Team

- ## SRC
  - ### Bob Vivona
    - CTAS developer: DA, TMA (DIA), UPR, CPTP
  - ### Tony Serino
    - Controller, AT Manager: Boston ATCT, TRACON, ARTCC

- ## Federal Data Corporation
  - ### Ed Spring
    - Manager: PHL ATCT/TRACON and ZDC ARTCC
    - Manager: Eastern Region ATC Division
  - ### Gordon Heritage
    - ZDC Controller, Data Systems Officer, Assistant Mgr.

Task Description: Approach

- Collect Site Data
  - Letters of Agreement, airspace charts, etc.
- Perform Site Visits
  - PHL, ZDC, ZNY, ZFW/DFW, Ames, Lincoln
- Document PHL/ZNY/ZDC Operations
- Develop Operational Concepts
- Detail "Most Likely" Concepts
- Assess Functional/Adaptation/NAS Changes
- Develop Work Plan and Staffing Needs

Task Description: Deliverables

- Item 1: Preliminary Plan and Scope - 08/03/98

- Item 2: Documentation of Arrival Procedures - 09/15/98

- Item 3: Documentation of Candidate Concepts - 01/15/99

- Item 4: Outline of Work Plan and Staffing - 01/15/99

- Item 5: Source Documentation - 01/15/99

Results

- Description of PHL
- PHL vs. DFW
- Benefit Mechanisms
- Multi-Facility Issues
- Multi-Facility Solutions
- Candidate Concepts
- Selected Concepts
- Adaptation Requirements
- Required NAS Changes
- Work Plan and Staffing

Results: Description of PHL

- Busy, Level V Terminal in Northeast Corridor
- Expanding US Airways hub
- Several other major airports nearby
  - including 26 airports with instrument approaches
- Airport on boundary between ZNY and ZDC
  - fed significant traffic from both ARTCCs
  - both ARTCCs feed other terminals
- Four metering fixes:
  - ZNY: BUNTS and MAIZE
  - ZDC: TERRI and VCN (Cedar Lake)

Results:
Description of PHL
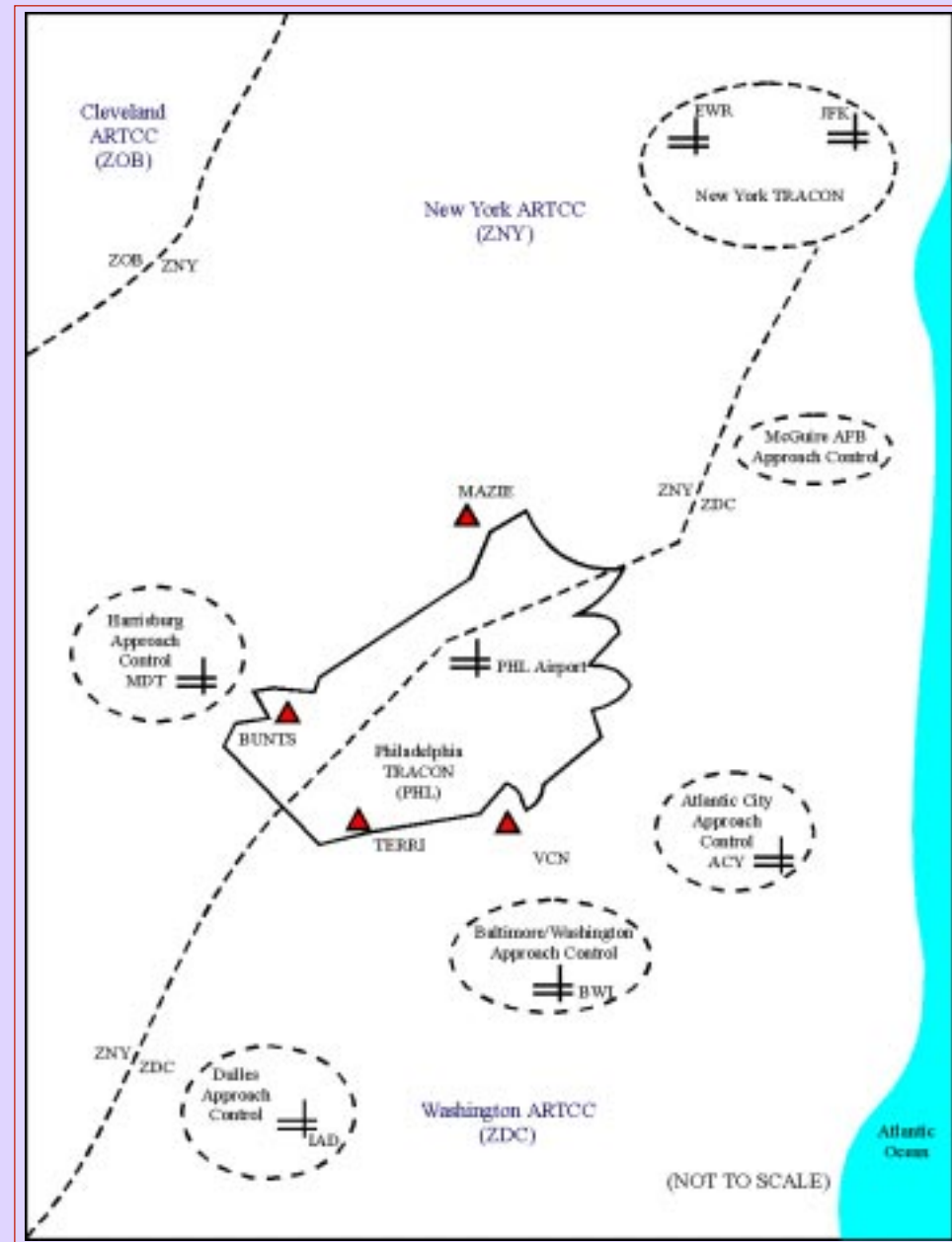
Results: Description of PHL

- Runway layout slide

Results: PHL vs. DFW

- Two ARTCCs feed traffic (ZNY and ZDC)
- Two ARTCCs handle significant traffic flows to other terminals besides PHL
- Cleveland ARTCC interacts with ZNY arrivals to PHL during holding
- Holding occurs as a normal method for absorbing delay
  – several times a day, most days of the week
- Single jet arrival runway operation
- ARTCC TMUs do not currently meter traffic

Results: PHL vs. DFW

- **PHL TMU not staffed on a full time basis**
- **ARTCC sector sizes generally smaller**
  - delay absorption within sector restricted
- **Tower/En Route traffic load significant**
- **ATSCC active role in traffic management**
  - approve/reject request for MIT restrictions

- Reduce holding through prediction of TRACON saturation
  - identify minimum restrictions
  - increase coordination between facilities (ZOB)
  - increase ATSCC acceptance of restrictions
  - reduce gaps in arrivals due to holding
  - free airspace for departures
  - decrease fuel burn at lower altitudes
  - remove ripple effect on traffic to other terminals
- Normal TMA benefit mechanisms
  - including possible use of multiple runways

Results: Multi-Facility Issues

- **Distributed data**
  - Current TMA receives/sends data from/to one facility (Host)
  - Data from both facilities required for "complete" knowledge of traffic and its impact
  - Functionality assumes display to one TMU

- **Distributed authority**
  - TMA assumes TMU has ability to manipulate all traffic to achieve best solution
  - Authority over PHL traffic is spread between two ARTCCs

Results: Multi-Facility Solutions

- Procedural distribution (dependent)
  - Create "Super ARTCC"
  - implement a single TMA with active displays in all active facilities (e.g., ZNY and ZDC)
  - combine ACES data and correlate traffic data
  - functionally ignore distinction between facilities
  - procedurally distribute authority and restrict impacts of "other facility"
  - Pros: complete traffic picture; maximum flexibility
  - Cons: heavy coordination required

- **Limit functional scope of TMA (independent)**
  - implement separate TMA in each active facility
  - separate arrival rate between facilities
  - adapt TMA for each facility independently (similar to current adaptation)
  - authority and functionality limited to limits of each facility
  - non-active facilities can be free flow or have independent restrictions (e.g., MIT)
  - Pros: minimum of coordination required
  - Cons: restricted benefits due to limited traffic information

Results: Multi-Facility Solutions

- Scaling of benefits
  - metering => most flexibility; largest benefits
  - metering in each ARTCC independently => reduced flexibility; reduced benefits
  - fixed MIT restrictions => least flexibility; least benefits
- Both MIT and metering are viable options to achieve "reduced holding" benefit mechanism
- Degree of metering will define achievable degree of "normal TMA" benefit mechanisms

Results: Candidate Concepts

- **Discriminators**
  - TMU(s) given solution responsibility
  - coordination required

- **General to all concepts**
  - coordination required between each ARTCC and PHL TRACON
  - displays in each facility supports coordination
  - all restrictions coordinated with and implemented by impacted ARTCC TMU

Results: Candidate Concepts

- **TRACON Concept**
  - TMA adapted as "Super ARTCC"
  - TRACON TMU develops "equivalent" MITs
  - MIT restrictions coordinated with ARTCC(s)
  - Pro: single TMU has complete information
  - Pro: TRACON TMU has no bias toward facilities
  - Pro: use of MIT restrictions is well known
  - Con: use of MIT constraints restricts benefits
  - Con: ARTCC coordination required to implement solution
  - Con: lack of expandability

Results: Candidate Concepts

- **Single Center - Independent**
  - TMA adapted/implemented w/in single ARTCC
  - "other" ARTCC in free flow
  - division of acceptance rates required
  - metering performed within single ARTCC
  - slave display in "other" ARTCC not required
  - PRO: requires minimal change to existing TMA
  - CON: arrival rate split limits benefits
  - CON: benefits only achieved in one ARTCC
  - CON: only effective when one ARTCC dominates

Results: Candidate Concepts

- **Single Center - Dependent**
  - TMA adapted as "Super ARTCC"
  - TMA implemented within single ARTCC (lead)
  - lead ARTCC develops solutions for both ARTCC and coordinates implementation
  - most likely mix metering (lead) and MIT (other)
  - PRO: Cons of independent concept avoided
  - CON: increased coordination required between the ARTCCs
  - CON: political sensitivities between two ARTCC

Results: Candidate Concepts

- **Dual-Center - Independent**
  - in essence: two Single Center - Independent systems running simultaneously
  - each ARTCC has its own TMA and implements its own metering independent from other ARTCC
  - slave displays in other ARTCCs facilitates coordination, if desired
  - PRO: same as Single Center - Independent
  - PRO: allows for entire traffic to be handled
  - PRO: coordination between ARTCCs possible, but not required
  - CON: acceptance rate divided

- Dual Center - Dependent
  - true "Super ARTCC" configuration
  - both ARTCC interact with same TMA system
  - coordination between ARTCCs handled both procedurally and functionally (within TMA)
  - PRO: metering in both ARTCCs is completely integrated
  - PRO: full TMA capabilities realizable
  - CON: extremely high amounts of coordination required between the ARTCC (rippling)
  - CON: significant changes to TMA software required

Results: Selected Concepts

- All concepts proposed would gain benefits
- Most desirable tradeoff between benefits and risks:
    - TRACON Concept (low risk)
    - Dual Center - Independent (higher benefits)
- More detail in report
    - detailed concept
    - scenario
    - required functional enhancements

Results: Adaptation Requirements

- Combining ACES data required for "Super ARTCC" adaptation
  - No show stoppers expected
  - biggest issue expected: point of tangency
- Combining Host data required for "Super ARTCC" adaptation
  - significant data source issue
  - potential solutions:
    - use ZNY Host (unlikely)
    - merge feeds from ZNY and ZDC Hosts w/in CTAS
    - use ETMS to merge feeds

Results: Required NAS Changes

- Software/Hardware
  - ETMS integration required for ZOB (as ZFW)
  - possible Host modification for "Super ARTCC" data feed (doubtful)

- Roles & Responsibilities: PHL TMU
  - increased staffing required
  - provide data for TMA (all concepts)
  - role in working with TMA (concept dependent)

- Roles & Responsibilities: ARTCC Airways Facilities and Automation Staff
  - support integration

- Roles & Responsibilities: ARTCC TMUs
  - implement TMA restrictions
  - develop TMA solutions (Center concepts)
  - perform metering (selected concepts)
  - improved strategic function
  - new Standard Operating Procedures will need to be developed
  - LOAs will need to be modified
- Roles & Responsibilities: ARTCC Controllers
  - metering (selected concepts)

Results: Work Plan & Staffing

- **Work Plan outline**
  - concept selection
  - benefits analysis
  - requirements definition
    - Management (HQ, Eastern Region, PHL, ZNY, ZDC) and facility (PHL, ZNY, ZDC) briefings
  - prototype software development
  - development simulations
  - procedures development
  - evaluation (SDT) simulations
  - "shadow" field testing
  - operational field testing

- **Required FAA participation**
  - FAA Eastern Region operations specialists
    - required for inter-facility coordination
  - FAA Headquarters (desired, but optional)
  - PHL TRACON
    - traffic management; facility training; facility operations and procedures; union reps; automation
  - ZNY and ZDC ARTCC
    - traffic management; facility training; facility operations and procedures; union reps; automation

Conclusions

- Large potential for achieving benefits by implementing TMA at PHL

- Multi-facility issues can be handled without prohibitive changes to TMA

- One of several concepts can achieve the desired benefits

- Next Steps:
  - select concept
  - begin requirements and benefits analyses
  - start prototype development